

CLAIMS

What is claimed is:

1. A method for protecting an animal subject against lethal infection with *B. anthracis*, comprising:
 - 5 administering an immunogenic composition which comprises purified or recombinant *B. anthracis* lethal factor (LF) protein or an immunogenic fragment thereof to the subject.
 2. The method of claim 1 wherein the immunogenic composition comprises a mutated LF protein or an immunogenic fragment of an LF protein, and
 - 10 further comprising administering an immunogenic composition which comprises purified or recombinant *B. anthracis* protective antigen (PA) protein or an immunogenic fragment thereof to the subject.
 3. The method of claim 1 wherein the LF protein comprises a sequence which is at least 90% identical to a sequence extending from amino acid 1 through amino acid 775 of the sequence set forth in SEQ ID NO:2.
 4. The method of claim 1 wherein the LF protein fragment comprises a sequence which is at least 90% identical to a sequence extending from amino acid 9 through amino acid 252 of the sequence set forth in SEQ ID NO. 2.
 5. The method of claim 2 wherein the PA protein comprises a sequence which is at least 90% identical to a sequence extending from amino acid 1 through amino acid 735 of the sequence set forth in SEQ ID NO. 4.
 6. The method of claim 2 wherein the PA protein fragment comprises a sequence which is at least 90% identical to a sequence extending from amino acid 175 through amino acid 735 of the sequence set forth in SEQ ID NO. 4.
 7. A method for protecting a susceptible animal subject against lethal infection with *B. anthracis*, comprising:

administering a nucleic acid-based immunogenic composition which comprises an isolated polynucleotide which encodes a mutated *B. anthracis* lethal factor (LF) protein or an immunogenic fragment thereof to the subject, said polynucleotide being operably linked to a promoter which drives expression of the mutated LF protein or the immunogenic LF protein fragment.

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8. The method of claim 7 further comprising administering an immunogenic composition which comprises an isolated polynucleotide which encodes *B. anthracis* protective antigen (PA) protein or an immunogenic fragment thereof to the subject, said polynucleotide being operably linked to a promoter which drives expression of the PA protein or immunogenic fragment thereof in the subject.

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9. The method of claim 7 wherein the LF protein comprises a sequence which is at least 90% identical to a sequence extending from amino acid 1 through amino acid 775 of the sequence set forth in SEQ ID NO:2.

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10. The method of claim 7 wherein the LF protein fragment comprises a sequence which is at least 90% identical to a sequence extending from amino acid 9 through amino acid 252 of the sequence set forth in SEQ ID NO. 2.

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11. The method of claim 8 wherein the PA protein comprises a sequence which is at least 90% identical to a sequence extending from amino acid 1 through amino acid 735 of the sequence set forth in SEQ ID NO. 4.

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12. The method of claim 8 wherein the PA protein fragment comprises a sequence which is at least 90% identical to a sequence extending from amino acid 175 through amino acid 735 of the sequence set forth in SEQ ID NO. 4.

13. The method of claim 7 wherein the polynucleotide is a component of a nucleic acid-based vaccine

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14. The method of claim 7 wherein the polynucleotide is a component of a viral vaccine.

15. The method of claim 8 wherein administration of the LF polynucleotide and the PA polynucleotide enhance production of antibodies to LF and PA protein in the subject.

16. The method of claim 8 further comprising administering a peptide-based immunogenic composition to the subject, said second immunogenic composition comprising an immunogen selected from the group consisting of a mutated LF protein, an immunogenic fragment of an LF protein, a PA protein, an immunogenic fragment of a PA protein, and combinations thereof, wherein said second immunogenic composition is administered to the subject before or after administration of the polynucleotide-based immunogenic composition.

17. An immunogenic composition for preparing a vaccine which protects a subject against lethal infection *B. anthracis*, said immunogenic composition comprising a purified or recombinant lethal factor (LF) protein or immunogenic fragment thereof and a pharmaceutically acceptable carrier or diluent.

18. The immunogenic composition of claim 17 wherein said immunogenic composition comprises a mutated LF protein or an immunogenic fragment of an LF protein and a purified or recombinant *B. anthracis* PA protein or immunogenic fragment thereof.

19. The immunogenic composition of claim 18 wherein the mutated LF protein comprises a sequence which is at least 90% identical to a sequence extending from amino acid 1 through amino acid 735 of the sequence set forth in SEQ ID NO:2.

20. The immunogenic composition of claim 18 wherein the LF protein fragment comprises a sequence which is at least 90% identical to a sequence extending from amino acid 9 through amino acid 252 of the sequence set forth in SEQ ID NO. 2.

22. The immunogenic composition of claim 18 wherein the PA protein comprises a sequence which is at least 90% identical to a sequence extending from amino acid 1 through amino acid 735 of the sequence set forth in SEQ ID NO. 4.

22. The immunogenic composition of claim 18 wherein the PA protein fragment comprises a sequence which is at least 90% identical to a sequence extending from amino acid 175 through amino acid 735 of the sequence set forth in SEQ ID NO. 4.

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23. A nucleic-acid based immunogenic composition for preparing a vaccine which protects a subject against lethal infection *B. anthracis*, said immunogenic composition comprising a polynucleotide which encodes a mutated lethal factor (LF) protein or immunogenic fragment of LF protein and a pharmaceutically acceptable carrier or diluent.

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24. The immunogenic composition of claim 23 further comprising an isolated polynucleotide which encodes *B. anthracis* protective antigen (PA) protein or an immunogenic fragment thereof to the subject, said polynucleotide being operably linked to a promoter which drives expression of the PA protein ,

25. The immunogenic composition of claim 24 wherein the PA polynucleotide comprises a sequence comprising consecutively nucleotide 610 through nucleotide 2295 of the sequence set forth in SEQ ID NO. 3.

26. The immunogenic composition of claim 24 wherein the LF polynucleotide and the PA polynucleotide are on separate DNA constructs.

27. The immunogenic composition of claim 24 wherein the LF polynucleotide and the PA polynucleotide are on the same DNA construct.

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28. A method for inducing an immune response which inactivates the *B. anthracis* toxin in an animal, said method comprising administering to the animal an immunogenic composition which comprises an isolated nucleic acid which encodes a mutated *B. anthracis* lethal factor (LF) protein or an immunogenic fragment of LF protein to the subject, said nucleic acid being operably linked to a promoter which drives expression of the mutated LF protein or the immunogenic LF protein fragment.

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29. The method of claim 26 further comprising administering an immunogenic composition which comprises an isolated nucleic acid which encodes *B. anthracis* protective antigen(PA) protein or an immunogenic fragment thereof to the subject, said nucleic acid being operably linked to a promoter which drives expression of the PA protein or immunogenic fragment thereof in the subject.

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30. The method of claim 28 wherein the method protects the subject from challenge with a dose which is at least 3 times the LD₅₀ of the lethal toxin.